

CLAIMS

What is claimed is:

1 1. A method of initializing an ITU Recommendation G.729 Annex B voice activity
2 detection (VAD) device, comprising the steps of:
3 extracting a set of parameters from a signal that characterize said signal;
4 calculating an energy measure of said signal from said set of parameters;
5 comparing said energy measure with a reference value;
6 determining an initial value for an average of a noise characteristic of said signal;
7 and
8 counting the number of times said energy measure equals or exceeds said
9 reference level.

1 2. The method according to claim 1, further comprising the step of:
2 performing the sequential process of steps recited in claim 1 repeatedly, in their
3 listed order, until said number of times equals thirty-two.

1 3. A method of initializing an ITU Recommendation G.729 Annex B voice activity
2 detection (VAD) device, comprising the steps of:
3 extracting a set of parameters characterizing a signal from a digital representation
4 of said signal within a data frame, wherein said parameters are the autocorrelation
5 coefficients, which are derived in accordance with said Recommendation G.729, and are
6 denoted by $\{R(i)\}_{i=0}^q$;
7 calculating a full-band frame energy by multiplying a value of ten times a base ten
8 logarithm of a quotient obtained by dividing a first autocorrelation coefficient $R(0)$, of
9 said autocorrelation coefficients, by a constant value of 240;
10 comparing said full-band frame energy with a reference level;
11 updating initial values for averages of the noise characteristics in accordance with
12 said Recommendation G.729 Annex B; and

13 changing the value of a frame counter during said initialization only if said full-
14 band frame energy equals or exceeds said reference level.

1 4. The method according to claim 3, further comprising the step of:
2 performing the sequential process of steps recited in claim 3 repeatedly, in their
3 listed order, until said frame count has been changed thirty-two times.

1 5. A method of converging an ITU Recommendation G.729 Annex B voice activity
2 detection (VAD) device, comprising the steps of:

3 determining a noise identification threshold value;
4 comparing a number of energy measures of a signal to said noise threshold value;
5 determining a first value representing an average of said number of energy
6 measures, when said energy measure is less than said noise threshold, wherein only the
7 energy measures of said number of energy measures having values less than said noise
8 threshold value are used to determine said first value;
9 determining a second value representing an average of said number of energy
10 measures; and
11 substituting said first value for said second value when a specific event occurs.

1 6. The method according to claim 5, wherein:
2 said specific event is an increasing divergence between said first and second
3 values with time.

1 7. The method according to claim 5, wherein:
2 said specific event is the expiration of a period of time.

1 8. The method according to claim 5, further comprising the step of:
2 counting the number of consecutive times said energy measures of said number of
3 energy measures equal or exceed a reference value, wherein

4 only the energy measures of said number of energy measures having values less
5 than said reference value are used to determine said second value, and
6 said specific event is a predetermined number of consecutive times said energy
7 measures of said number of energy measures equal or exceed said reference value.

1 9. A method of converging an ITU Recommendation G.729 Annex B voice activity
2 detection (VAD) device, comprising the steps of:

3 determining a noise identification threshold value;
4 comparing a number of energy measures of a signal to said noise threshold value;
5 determining a differential spectral distance, ΔSD , between a current spectral state
6 of said signal and a value representing an average of a number of prior spectral states of
7 said signal;

8 updating a first set of values representing averages of said signal's noise
9 characteristics, when said energy measure is less than said noise threshold;

10 updating a second set of values representing averages of said signal's noise
11 characteristics, when said energy measure is less than a reference value and said
12 differential spectral distance has a value less than about 0.0637; and

13 substituting said first value for said second value when a specific event occurs.

1 10. The method according to claim 9, further comprising the step of:

2 counting the number of consecutive times said energy measures of said number of
3 energy measures equal or exceed said reference value, wherein

4 said specific event is a predetermined number of consecutive times said energy
5 measures of said number of energy measures equal or exceed said reference value.

1 11. The method according to claim 5, further comprising the steps of:

2 determining the lesser of two values T_1 and T_2 ;

3 multiplying said lesser value of T_1 and T_2 by two to obtain a product;

4 comparing said product to a value of -21 dBm;

5 assigning the lesser value of -21 dBm and said product to said noise threshold
6 value for an updating period, τ_p .

1 12. The method according to claim 9, further comprising the steps of:
2 determining the lesser of two values T_1 and T_2 ;
3 multiplying said lesser value of T_1 and T_2 by two to obtain a product;
4 comparing said product to a value of -21 dBm;
5 assigning the lesser value of -21 dBm and said product to said noise threshold
6 value for an updating period, τ_p .

1 13. The method according to claim 11, further comprising the steps of:
2 measuring the maximum block energy occurring during said updating period, τ_p ,
3 and assigning said measured maximum block energy to E_{\max} ;
4 measuring the minimum block energy occurring during said updating period, τ_p ,
5 and assigning said measured maximum block energy to E_{\min} ;
6 calculating said value of T_1 given by the equation $T_1 = E_{\min} + (E_{\max} - E_{\min})/32$; and
7 calculating said value of T_2 given by the equation $T_2 = 4 * E_{\min}$.

1 14. The method according to claim 12, further comprising the steps of:
2 measuring the maximum block energy occurring during said updating period, τ_p ,
3 and assigning said measured maximum block energy to E_{\max} ;
4 measuring the minimum block energy occurring during said updating period, τ_p ,
5 and assigning said measured maximum block energy to E_{\min} ;
6 calculating said value of T_1 given by the equation $T_1 = E_{\min} + (E_{\max} - E_{\min})/32$; and
7 calculating said value of T_2 given by the equation $T_2 = 4 * E_{\min}$.

1 15. A method of converging an ITU Recommendation G.729 Annex B voice activity
2 detection (VAD) device, comprising the steps of:

3 measuring the maximum block energy occurring during an updating period, τ_p , and
 4 assigning said measured maximum block energy to E_{\max} ;
 5 measuring the minimum block energy occurring during said updating period, τ_p ,
 6 and assigning said measured maximum block energy to E_{\min} ;
 7 calculating a value of T_1 given by the equation $T_1 = E_{\min} + (E_{\max} - E_{\min})/32$;
 8 calculating a value of T_2 given by the equation $T_2 = 4 * E_{\min}$;
 9 determining the lesser value of said values T_1 and T_2 ;
 10 multiplying said lesser value of T_1 and T_2 by two to obtain a product;
 11 comparing said product to a value of -21 dBm;
 12 assigning the lesser value of -21 dBm and said product to a noise threshold value;
 13 comparing a number of energy measures of a signal to said noise threshold value;
 14 determining a differential spectral distance, ΔSD , between a current spectral state
 15 of said signal and a value representing an average of a number of prior spectral states of
 16 said signal;
 17 updating a first set of values representing averages of said signal's noise
 18 characteristics, when said energy measure is less than said noise threshold;
 19 updating a second set of values representing averages of said signal's noise
 20 characteristics, when said energy measure is less than a reference value and said
 21 differential spectral distance has a value less than about 0.0637;
 22 counting the number of consecutive times said energy measures of said number of
 23 energy measures equal or exceed said reference value; and
 24 substituting said first value for said second value when said number of consecutive
 25 times exceeds a predetermined value.

14. The method according to claim 12, further comprising the step of:

2 updating said noise threshold value about every 1.28 seconds during a
 3 communication link.